


DATE: November 1, 2021

FILE REF: 3400

TO: File

FROM: Woody Myers - WCR 

SUBJECT: - Land Disposal System Evaluation Report, WPDES Permit # WI-0024171

Effluent & Groundwater Evaluation Summary**Table 1 Land Treatment Effluent Parameters and Limits**

Parameter	Current Permit WI-		Proposed Permit WI-	
	Limits and Units	Limit Type	Limits and Units	Limit Type
Flow Rate	- MGD		- MGD	
Total Nitrogen	10 mg/l	Monthly Avg	10 mg/l	Monthly Avg
BOD ₅	50 mg/l	Monthly Avg	50 mg/l	Monthly Avg
Total Suspended Solids	- mg/l		- mg/l	
pH, Field	6.0-9.0 su		6.0-9.0 su	
Chloride	250 mg/l	Monthly Avg	250 mg/l	Monthly Avg
Total Dissolved Solids	- mg/l		- mg/l	
Ammonia	- mg/l		- mg/l	
Kjeldahl Nitrogen	- mg/l		- mg/l	
Nitrite + Nitrate as N	- mg/l		- mg/l	
Organic Nitrogen	- mg/l		- mg/l	

No recommended changes from previous permit

Table 2 Monitoring Wells

Well	Current Permit WI-0024171-10		Proposed Permit WI-0024171-11	
	Well Location	Well Designation	Well Location	Well Designation
801 MW-1	Down-gradient	Non-Point of Standard	Down-gradient	*Point of Standard
802 MW-2	Down-gradient	Non-Point of Standard	Down-gradient	Non-Point of Standard
803 MW-3	Side-gradient	Non-Point of Standard	*Down-gradient	*Point of Standard
806 MW-6	Up-gradient	Background	*Side-gradient	*Non-Point of Standard
807 MW-7	Down-gradient	Non-Point of Standard	Down-gradient	Non-Point of Standard
808 MW-8	Down-gradient	Non-Point of Standard	Down-gradient	Non-Point of Standard
809 MW-9	Up-gradient	Background	Up-gradient	Background

A point of Standard well was formerly and inaccurately labeled an ES or Compliance well.

* Recommended changes from previous permit

Table 3 Groundwater Standards

Parameter	Current Permit WI-0024171-10		Proposed WI-0024171-11	
	PAL	ES	PAL	ES
Depth to Groundwater	N/A	N/A	N/A	N/A
Groundwater Elevation	N/A	N/A	N/A	N/A
Chloride	200 mg/l (ACL)	250 mg/l	*180 mg/l (ACL)	250 mg/l
Nitrogen, Organic	2.3 mg/l	N/A	2.3 mg/l	N/A
Nitrogen, Nitrite + Nitrate	8.9 mg/l (ACL)	10.0 mg/l	8.9 mg/l (ACL)	10.0 mg/l
pH	6.0-8.0 su	N/A	6.0-8.0 su	N/A
Nitrogen, Ammonia	1.1 mg/l (ACL)	9.7 mg/l	*0.97 mg/l	9.7 mg/l
Total Dissolved Solids	790 mg/l	N/A	790 mg/l	N/A

* Recommended changes from previous permit

Site Information

The Hammond Wastewater Treatment Facility is a municipal facility located at Ridgeway Street, Hammond, St. Croix County. Wastewater is currently treated via a sequency batch reactor and discharged groundwater via absorption ponds (seepage cells) located in the SW ¼ of the NE ¼ of Section 28, T29N, R17W, Town of Hammond.

Geology

This facility is in close proximity to the boundary of Prairie du Chien group and the Ancell Group. The Prairie du Chien Group includes the Shakopee and Oneota Formations with the Willow River, New Richmond, Hager City and Stockton Hill Members. The Prairie du Chien is comprised of dolomite with some variation in the New Richmond Member which ranges from a sandstone to siltstone. The Ancell Group includes the Glenwood and St. Peter formations. The Glenwood Formation is comprised of shale and the St. Peter is comprised of an orthoquartzitic sandstone with minor occurrences of conglomerate (*Bedrock Geology of Wisconsin, Regional Map Series West-Central Sheet*, Wisconsin Geological and Natural History Survey (WGNHS), 1988). Bedrock has been encountered as shallow as 20 feet below ground surface (bgs) based on on-site soil borings. The regolith consists of material ranging from silt to gravel. Surface soil primarily consists of the Jewett silt loam and the Santiago silt loam (USDA Web Soil Survey).

Hydrogeology

Calculated groundwater elevation ranges between 1043 and 1055 feet above mean sea level (msl). Depth to groundwater was reported to be between 40 and 72 feet bgs. Groundwater flow direction was calculated to be to the north-northwest. Regional groundwater is to the northwest in this area of St. Croix County (Generalized Water-Table Elevation Map of St. Croix County, Wisconsin, WGNHS 1990). The site is approximately 1,250 feet west of the South Branch of the Kinnikinic River.

A review of known wells was performed as a part of this evaluation. These wells include municipal, other than municipal, private and high-capacity wells. There are 2 private wells within a 1,500-foot range of this facilities groundwater discharge.

Hydraulic and Nitrogen Loading Rates

There are three active outfalls at this facility. Land Treatment Outfall 005 is the discharge associated with the groundwater monitoring network.

Table 4 Sampling Points/Outfalls

Sampling Point (Outfall) Listed in SWAMP		
Number	Outfall Type	Description
Outfall 702	Influent	Influent
Outfall 003	Municipal Sludge	Seq Batch Reactor Sludge
Outfall 005	Land Treatment	Discharge to absorption ponds

The following table is the average flow (hydraulic loading), total nitrogen and chloride loading summations for the Land Treatment System.

Table 5 Land Treatment Disposal Loading Averages

Year	Flow (MGD)	Nitrogen (mg/l)	Chloride (mg/l)
2021*	0.091	4.9	166
2020	0.097	9.3	169
2019	0.100	5.3	209
2018	0.098	6.1	215
2017	0.094	6.4	156
2016	0.099	6.6	165

* Indicates partial year

Groundwater Monitoring Network and Frequency

Groundwater samples were to be collected semi- annually from six of the seven wells. Samples were not required to be collected from well 803, but depth to groundwater measurements were required. Well 806 and 809 were used to calculate Preventative Action Limits (PAL) and Alternate Concentration Limits (ACL). No wells were designated and sampled as "Point of Standard Application" wells.

Table 6 Groundwater Monitoring Well Data

Sample Point	Well Name	Elevation (feet above msl)					Well Type
		Casing Top	Ground Surface	Screen Top	Screen Bottom	Screen Length	
801	MW-1	1133.58	1132.0				
802	MW-2	1120.43	1120.0				
803	MW-3	1115.97	1113.6	1035.0	1025.0	10.0	WT
806	MW-6	1106.90					WT
807	MW-7	1108.17	1105.2	1043.2	1033.2	10.0	WT
808	MW-8	1102.73	1099.8	1044.3	1034.3	10.0	WT
809	MW-9	1094.11	1091.0	1045.0	1035.0	10.0	WT

All measurements in feet

WT-Water table Observation P-Piezometer O-Other

The groundwater samples are analyzed for the following parameters: Nitrite + Nitrate, Chloride, Ammonia, Organic Nitrogen, pH and Total Dissolved Solids (TDS). All of these parameters are analyzed for the aqueous or dissolved phase in groundwater. Established groundwater quality standards are found in s. NR140.10 Table 1 Public Health Groundwater Quality Standards, and NR140.12 Table 2 Public Welfare Groundwater Standards. The thresholds of these standards are the Enforcement Standard (ES) and the PAL.

Groundwater Conditions and Exceedances

Groundwater sampling results from this facility have been analyzed for each well to evaluate trends of regulated compounds in groundwater and to calculate PALs and ACLs where appropriate. The groundwater was evaluated by looking at approximately five years of monitoring results. PALs and ACLs are calculated from this time range.

The groundwater monitoring well 806 has been determined to be a side gradient well. It is assumed to be outside of the influence of the absorption ponds. There is a long history of chloride exceeding the ES. When comparing the sampling results to the average effluent concentrations for chloride the groundwater results are greater. The conclusion of this evaluation is the well 806 should not be used for determining groundwater compliance or be used to calculate PALs and ACLs. Elevated levels of TDS are frequently observed in groundwater with elevated chloride. Well 806 will not be included in the following evaluation of the groundwater compliance.

The monitored groundwater exceedances trend summary is as follows:

MW-1 (801)

Nitrogen, Nitrite + Nitrate

1 of 11 samples exceeded the ES

0 of 11 samples exceeded the PAL

maximum: 15.4 mg/l minimum: 6.3 mg/l average: 7.8 mg/l

MW-2 (802)

Chloride

0 of 11 samples exceeded the ES

1 of 11 samples exceeded the PAL

maximum: 224mg/l minimum: 109 mg/l average: 152 mg/l

Nitrogen, Nitrite + Nitrate

2 of 11 samples exceeded the ES

0 of 11 samples exceeded the PAL

maximum: 11.8 mg/l minimum: 4.6 mg/l average: 6.7 mg/l

TDS

1 of 11 samples exceeded the PAL

maximum: 1086 mg/l minimum: 433 mg/l average: 605 mg/l

MW-8 (808)

Chloride

0 of 11 samples exceeded the ES

1 of 11 samples exceeded the PAL

maximum: 204mg/l minimum: 40 mg/l average: 91 mg/l

Nitrogen, Nitrite + Nitrate

3 of 11 samples exceeded the ES

0 of 11 samples exceeded the PAL

maximum: 15.4 mg/l minimum: 3.0 mg/l average: 7.0 mg/l

Concentrations and trends in the groundwater monitoring data were compared to the loading data for the land treatment system. There is no correlation between the effluent loading levels and the groundwater monitoring results.

Proposed Groundwater Monitoring Requirements

The groundwater monitoring wells should be sampled semi-annually for the parameters in the table below. Groundwater limits were calculated using well 809. Wells 801 and 803 are suggested to change the designation and to be sampled as ch. NR140.22 Wis. Admin. Code Point of Standard Application well.

Table 7 Well Sampling Recommendations

Well Name	Sample Point	Sample Frequency	Sample Parameters	Well Designation
801	MW-1	Semi-annually	Table 8	*Point of Standard
802	MW-2	Semi-annually	Table 8	Non-Point of Standard
803	MW-3	Semi-annually	Table 8	*Point of Standard
806	MW-6	Discontinue		
807	MW-7	Semi-annually	Table 8	Non-Point of Standard
808	MW-8	Semi-annually	Table 8	Non-Point of Standard
809	MW-9	Semi-annually	Table 8	Background

* Recommended changes from previous permit

Table 8 Proposed Groundwater Standards –Permit WI-00602224-09

Parameter	PAL	ES	Source
Depth to Groundwater	N/A	N/A	Measured
Groundwater Elevation	N/A	N/A	Measured
Chloride	*180 mg/l (ACL)	250 mg/l	Calculated, Table 2, NR 140
Nitrogen, Organic	2.3 mg/l	N/A	Calculated
Nitrogen, Nitrite + Nitrate	8.9 mg/l (ACL)	10.0 mg/l	Calculated, Table 1, NR140
pH	6.0-8.0 su	N/A	Calculated
Nitrogen, Ammonia	*0.97 mg/l	9.7 mg/l	Table 1, NR 140
Total Dissolved Solids	790 mg/l	N/A	Calculated

*Recommended changes from previous permit

The rationale for the recommended changes to the groundwater sampling are: Wells 801 and 803 are designated as point of standards application wells due to their distance from the active absorption ponds. Well 803 should be sampled for all parameters to help determine potential impacts from agricultural practices. The ACL for chloride and ammonia have been reduced based on background groundwater quality data.

Conclusions

The groundwater monitoring wells appear to be adequately placed to determine compliance with groundwater standards.

The facility has been struggling with poor infiltration in the four absorption ponds (each at different magnitudes). In addition, there has been a long term ch. NR 140.10 Table 1 Wis. Adm. Code PAL exceedance for nitrite + nitrate. In the past this exceedance has been managed by applying an ch. NR140.28 Wis. Adm. Code exemption in the form of an ACL. The ACL raised the PAL from 2.0 mg/l to 8.9 mg/l. Typically, ACLs are established based on background groundwater data. In the case of

Hammond's WWTF the background groundwater quality does not support an ACL of this magnitude. However, it will be recommended to be continued in the next permit issuance. The slow infiltration rate limits the facility's ability to optimize the load rest cycles of the absorption ponds. Groundwater monitoring well 807 and 808 are down-gradient of the active absorption ponds but are less than 250 feet and therefore are not point of standards application wells. However, from the concentration in these wells the department can infer the concentrations at the DMZ.

Groundwater monitoring wells 801 and 803 are greater than 250 feet down-gradient of the active absorption ponds. This makes them a point of standards application well. However, they are directly adjacent to an agricultural field to the west of the wastewater facility. The field while being down-gradient of the wells is not significantly down-gradient. It is not clear if the nitrite + nitrate observed in wells 801 and 803 is a result of past facility practices, over application of agricultural fertilizers or a combination thereof. As a result, sampling parameters for well 803 have been increased from depth and elevation to the full list in Table 8.

The department views the investigations into infiltration improvement, optimizations of the sequencing batch reactor and other facility improvements as the ch. NR140.26 Wis. Adm. Code response actions for the ES exceedances observed in the groundwater monitoring wells.

Overall, the facility is found to be substantially compliant.

Compliance Schedule Recommendations

No compliance schedule recommendations.